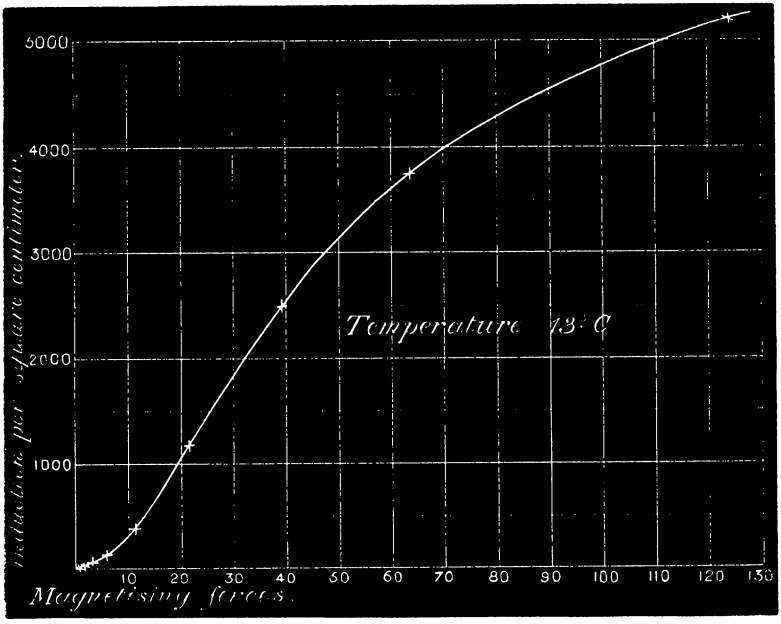
IV. "Magnetic Properties of Alloys of Nickel and Iron." By J. HOPKINSON, D.Sc., F.R.S. Received December 2, 1889.

Several alloys have been examined, supplied to me very kindly by Mr. Riley, of the Steel Company of Scotland. I confine myself to a brief statement of the results with the most interesting sample. Mr. Riley informs me that this sample contains 25 per cent. of nickel. As the material was given to me it was non-magnetic at ordinary temperature, that is to say, the permeability was small, about 1·4, and the induction was precisely proportional to the magnetising force. The ring on being heated remained non-magnetic up to 700° C. or 800° C. A block of the material did not recalesce on being heated to a high temperature and being allowed to cool.

On being placed in a freezing mixture the material became magnetic at a temperature a little below freezing point.

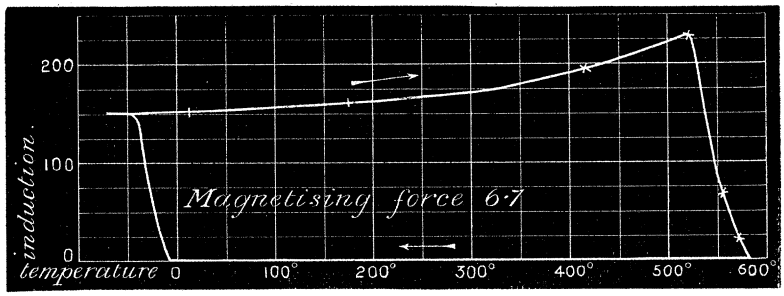
The material was next cooled to about −51° C., by means of solid carbonic acid, and the curve of magnetisation was ascertained, as shown in fig. 1, corresponding to a temperature of 13° C.; from this it will be seen that the ring of the material, which was previously

FIG. 1.



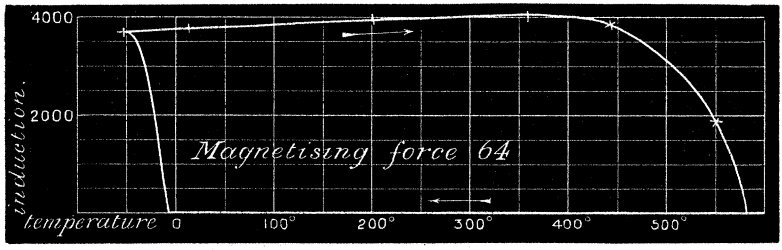
non-magnetic at 13° C., is now decidedly magnetic at the same temperature. On heating the material it remained magnetic until it reached a temperature of 580° C. At this temperature it became non-magnetic, and, on cooling, remained non-magnetic to the ordinary temperature of the room. Fig. 2 shows the inductions at various

FIG. 2.



temperatures, the abscissæ being temperatures for a magnetising force 6·7, whilst fig. 3 shows the induction in terms of the tempera-

FIG. 3.



ture to a different scale for a force of 64. These curves show that, for a range of temperature from somewhat below freezing to 580° C., this material exists in two states, either being quite stable, the one being non-magnetic, the other magnetic. It changes from non-magnetic to magnetic if the temperature be reduced a little below freezing; the magnetic state of the material does not change from magnetic to non-magnetic till the temperature is raised to 580° C.

The same kind of thing, in a much less degree, can be seen with ordinary steel. Over a small range this can exist in two states, but in changing its state from non-magnetic to magnetic a considerable amount of heat is liberated, which causes a rise of temperature of the steel. Whether any material quantity of heat is latent in the nickel steel I do not know.

FIG. 1.

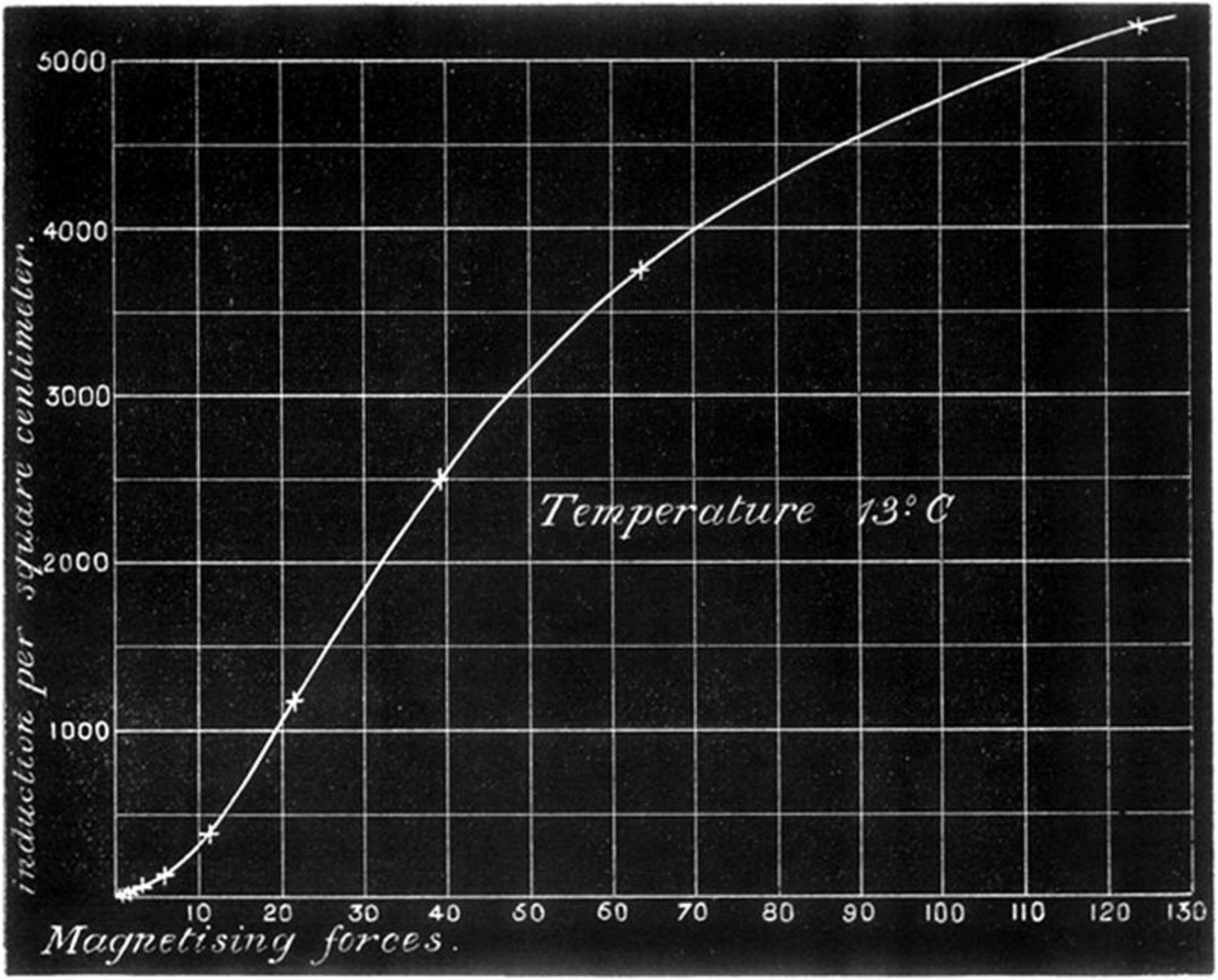

5000
4000
3000
2000
1000
Induction per square centimeter.
Temperature 13° C
10
20
30
40
50
60
70
80
90
100
110
120
130
Magnetising forces.

FIG. 2.

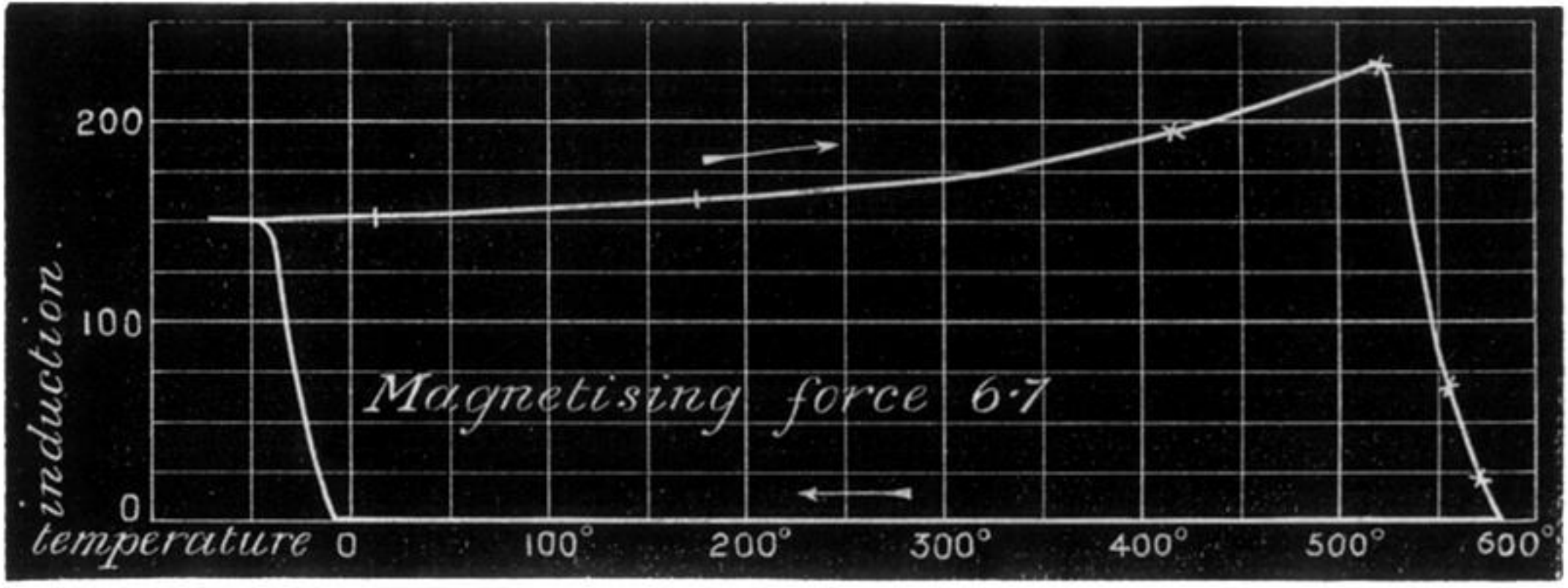
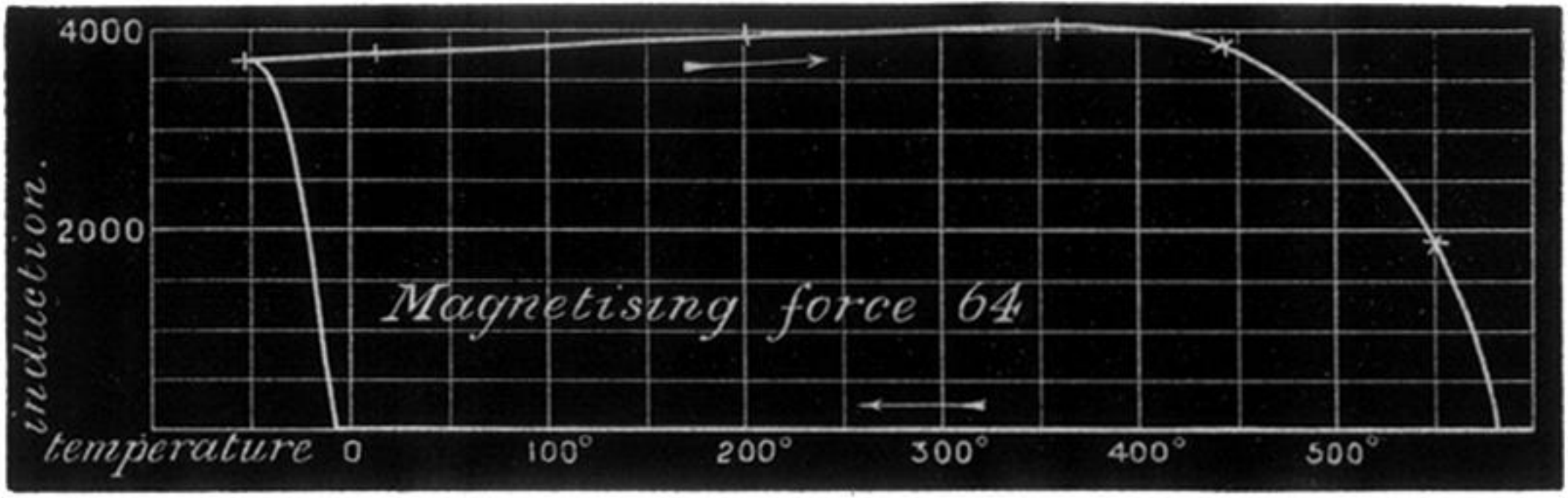

200
100
0
induction.
Magnetising force 6·7
temperature 0
100°
200°
300°
400°
500°
600°

FIG. 3.


4000
2000
induction.
Magnetising force 64
temperature
0
100°
200°
300°
400°
500°